BIRZEIT UNIVERSITY
MATHEMATICS DEPARTMENT
Stat 236
Summer semester 2014/2015- Midterm Exam

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$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$$

Z – Score: $z = \frac{x - \mu}{\sigma}$

Correlation coefficient: $r = \frac{s_{xy}}{s_x s_y} = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{n\sum x^2 - (\sum x)^2}\sqrt{n\sum y^2 - (\sum y)^2}}$

Covariance: $s_{xy} = \frac{\sum (x - \bar{x})(y - \bar{y})}{n-1}$

Permutations: $n\,Pr = \frac{n!}{(n-r)!}$

Combinations: $nC\,r = \frac{n!}{(n-r)!r!}$

Conditional probability: $p(A \setminus B) = \frac{p(A \cap B)}{p(B)}$

$p(A \cup B) = p(A) + p(B) - p(A \cap B)$

Uniform:

$E = \frac{a+b}{2}$

$Var. = \frac{(b-a)^2}{12}$

Discrete Random Variable $E(X) = \mu = \sum x f(x)$

$Var(X) = \sum (x - \mu))^2 f(x)$

Binomial Probability Distribution $P(X = x) = f(x) = \binom{n}{x} p^x (1-p)^{n-x}$

$E(X) = np, \quad \sigma(X) = \sqrt{np(1-p)}$

Poisson Probability : $f(x) = \frac{\mu^x e^{-\mu}}{x!}$

Exponential Probability Distribution $\boxed{f(x) = \frac{1}{\mu} e^{\frac{-x}{\mu}}}$

Question # 1: (22 points) Circle the correct answer.

1. Student's **university numbers** consist of numeric values. Therefore, student's number is an example of
   a. Quantitative data. (b) Qualitative data
2. The number Stat Quizzes in this semester is an example of what scale :
   a. Ordinal b. Nominal c. Interval (d) Ratio
3. which one of the following is a measure of Asymmetry:
   (a) The median (b) The skewness c. The IQR d. The covariance.
4. Which one of the following graphical presentation is appropriate for qualitative data:
   a. Histogram b. Ogive (c) pie chart d. cumulative frequency table
5. To study the relation between gender (male, female) and the Tawjihi average the appropriate summary is?
   a. Histogram. b Bar graph. (c) Cross tabulation. d. Scatter diagram.
6. If the frequency of a Business students is 100 from 720 Commerce students then its angle in the **pie chart** is:
   a. 25
   (b) 50
   c. 100
   d. 200
7. If A, B are two independent events, where P(A)= 0.4, P(AUB)=0.7, then P(B)=
   (a) 0.3
   b. 0.4
   (c) 0.5
   d. Can't be determined by the given informations.
8. How many **3-digit numbers** can be formed from the digits 2, 3, 4, 5, and 6, without repeating the digits??
   a. 3
   (b) 10
   c. 20
   (d) 60
9. An experiment consists of selecting a student body president and vice president. All undergraduate students (first year through fourth year) are eligible for these offices. How many sample points (possible outcomes as to the classifications) exist?
   a. 8
   (b) 16
   c. 32
   d. 64
10. The random variable x is known to be uniformly distributed between 50 and 90. Find P_{80} =
    a. 70 (b) 78 c. 80 d. 82

11. Events that have no sample points in common are

a. independent events.
b. mutually exclusive events.
c. complement events.
d. simple events.

12. in which distribution the data values have the same frequency:

a. Bimodal distribution
b. Uniform distribution
c. Poisson distribution.
d. Exponential distribution.

13. Suppose that X is a binomial random variable with 100 trials and probability of success equal 0.3. Find **the approximated probability** of at least forty successes

a. 0.9808
b. 0. 011
c. 0.0192
d. 0.0146

(14-15) Given the probability distribution of the number of family members

Number of family members (x)	2	3	4	5	6	7 or more
Probability P(X = x) = f(x)	0.03	a	0.39	0.26	0.1	0.08

14. Find $P(X \leq 4)$.

a. 0.17
b. 0. 44
c. 0.56
d. 0.83

15. Find E(X)=

a. 4
b. 4.5
c. 5.5
d. 6

(16-18) The average life for a TV set is 10 years. Suppose that the lifetime follows an **exponential distribution**.

16. Find The probability that the life time is between 3 and 6 years is

a. 0.153
b. 0.192
c. 0.741
d. 0.808

17. Find The probability that the life time is more than 5 years is

a. 0.6065
b. 0.6487
c. 0.3935
d. None of the above

$.75 = e^{-a}$ (m) .52

18. 75% of the TV life will be at most how long?

a. 2.8 years
b. 13.8 years
c. 32.1 years
d. 43.2 years

$\sigma = 4 \quad m = 20$

(19-21) AlBireh Arab Hospital has noted that they admit an average of 4 customers arrive at the bank every 20 min. Define the random variable X to be the number of admitted customers

19. What is the appropriate probability distribution for X? .

$\frac{40-20}{4} = 5$

a. Poisson
b. Binomial
c. Uniform
d. Exponential

20. Find the probability that 3 customers arrive in 40 min

$1 \rightarrow 20\,m$
$? \rightarrow 40\,m$

a. 0.0286
b. 0.1804
c. 0.1954
d. 0.8053

$\frac{2^3 \cdot e^{-2}}{3!}$ $\frac{\lambda^x e^{-m}}{x!}$ $\frac{5^3 \cdot e^{-5}}{3!}$

21. Find the probability that more than 2 customers arrive 20 min

a. 0.0915
b. 0.2381
c. 0.7619
d. 0.9085

$P(X > 2)$

$1 \rightarrow 20$

$\frac{1^2 \cdot e^{-1}}{2!}$

22. A basketball player has probability 0.8 of making a free shot. What is the probability that he makes exactly 3 if he throws 6 shots from the line?

a. 0.0819
b. 0.8202
c. 0.9131
d. 0.0381

$\binom{6}{3} .8^3 .2^3$

$20 \cdot$

$\binom{.8}{1}$

$P(\quad)$

$1 - (P(0) + P(1) + P(2))$

Question # 2 (8 points)

The following data show the number of hours worked by two workers x, y in 8 days . answer the following questions.

x	y	$(y-\bar{y})$	$(y-\bar{y})^2$	$(x-\bar{x})$	$(x-\bar{x})^2$	$(x-\bar{x})(y-\bar{y})$
2	5	-6	36	-5	25	30
4	7	-4	16	-3	9	12
8	9	-2	4	1	1	-2
5	12	1	1	-2	4	-2
7	10	-1	1	0	0	0
8	13	2	4	1	1	2
16	16	5	25	9	81	45
6	16	5	25	-1	1	-5
			112		122	80

1. Compute $\bar{x}$, $\bar{y}$

$\bar{X} = \frac{2+4+8+5+7+8+16+6}{8} = 7$

$\bar{Y} = \frac{5+7+9+12+10+13+16+16}{8} = 11$

2. Compute and **interpret** the sample **correlation coefficient**.

$r = \frac{S_{XY}}{S_X \cdot S_Y}$

$S_{XY} = \frac{\Sigma (x-\bar{x})(y-\bar{y})}{n-1} = \frac{80}{8-1} = 11.42857$

$S_X = \sqrt{\frac{\Sigma (x-\bar{x})^2}{n-1}} = \sqrt{\frac{122}{8-1}} = 4.1747$

$S_Y = \sqrt{\frac{\Sigma (y-\bar{y})^2}{n-1}} = \sqrt{\frac{112}{8-1}} = 4$

$r = \frac{11.42857}{(4.1747)(4)} = 0.68439$

Correlation Coefficient = .68439

↳ the relation is positive strong relation.

Question # 3 (8 points) على جدول

The distribution of scores for a particular exam follows a normal distribution with mean of 70 and standard deviation of 6. Answer the following:

a. Find the probability that a randomly selected student get more than 74.5 in the exam?
b. Find the probability that a randomly selected student get between 68.5 and 70 in the exam?
c. If the least 8% will fail the course, what is the Score should be obtained to avoid Failing the course?
d. If you got a score of 79 in this class, at what percentile is your score?

$M = 70 \quad \sigma = 6$

$Z = \frac{X - M}{\sigma}$

c) - 0.08 Fail

$0.5 - 0.08 = .92$

from table → $\frac{.9192 + .9207}{2} = 0.91995$

$Z = \frac{X - M}{\sigma}$

$0.91995 = \frac{X - 70}{6}$

$5.5197 = X - 70$

$+70 \quad +70$

$X = 75.5197$

a) $P(X > 74.5)$

$Z = \frac{74.5 - 70}{6} = 0.75$

from table → .67

The probability is → 0.67

b) → $P(68.5 < X < 70)$

$Z = \frac{68.5 - 70}{6} = -.25$

$Z = \frac{70 - 70}{6} = 0$

↳ $P(-.25 < x < 0)$

↳ $P(x < 0) - P(x < -.25)$

↳ $.50 - (1 - .5987)$

↳ $.5 - .4013 = 0.0987$

D) - a). find index.

$\frac{79}{100} \times n$

$\frac{79}{100} \times 100 = .79$

79%

Question # 4 (6 points)

The STAT grades of 50 students in the first and their genders are s hown below. Astudent is randomly selected from these 50

	STAT Grade			
Gender	Less than 20	20 up to 30	30 and more	Total
Female	4	16	12	32
Male	6	2	10	18
Total	10	18	22	50

Total. = 50 student

1. What is the probability that this student is male and his grade 20 up to 30?

Probability → $\frac{2}{50} = 0.04$

2. What is the probability that this student is female?

female → $\frac{32}{50} = 0.64$

3. What is the probability that this student has grade 20 and more?

$\frac{16+12+2+10}{50} = 0.8$

4. What is the probability that this student has grade less than 10 or female?

P (less than 10 / f)

→ $P(A/B) = \frac{P(A \cap B)}{P(B)} = \frac{4}{32} = 0.125$

more than 30

P<1

P<10

5. If this student has grade 30 and more, what is the probability that he is male?

$P(A/B)_M = \frac{P(A \cap B)}{P(M)} \rightarrow \frac{10}{18} = 0.556$

more than 30

6. If this student is female , what is the probability that her gra20 up 30. ?

P (female / grade 20up 30)

$= \frac{P(F \cap G\ 20up30)}{P(\text{Grade 2 up } 30)} = \frac{16}{18} = 0.8889$

Question # 5 (2 points)

The random variable X is known to be uniformly distributed where E(x)= 5, var(x)=$\frac{1}{3}$,
Write the probability density function. PDF

A and B

$a+b=10 \rightarrow (1)$

$-a+b=2 \rightarrow (2)$

$2b=12$

$b=6$

$a=4$

$E(x)=\frac{a+b}{2}$

$5=\frac{a+b}{2} \Rightarrow a+b=10 \rightarrow (1)$

$var=\frac{(b-a)^2}{12}$

$\frac{1}{3}=\frac{(b-a)^2}{12}$

$12=3(b-a)^2$

$4=(b-a)^2$

$2=b-a \rightarrow (2)$

Question # 6 (4 points)

Stat Sections in this summer are 6, the probability that a class don't cover all stat material is 10%, Find the probability that

a. Two sections will cover the material. P= 2
b. At least one section will not cover stat material

a) $-\binom{6}{2}(0.9)^2 \cdot (.1)^4$

$=(15)(.81)\cdot(.1)^4$

$=1.215\times10^{-3}$

b) $1-P(0)$

$\binom{6}{0}(.1)^0(.9)^6$

$=(1)(1)(0.531441)=0.531441$

$1-0.531441$

$=0.468559$

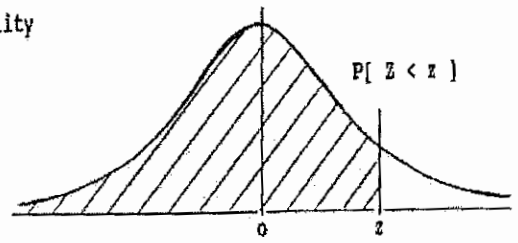
STANDARD STATISTICAL TABLES

1. Areas under the Normal Distribution

The table gives the cumulative probability up to the standardised normal value z

i.e.

$$P[\,Z < z\,] = \int_{-\infty}^{z} \frac{1}{\sqrt{2\pi}} \exp(-\tfrac{1}{2}z^2)\, dz$$



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5159	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7854
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8804	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9773	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9865	0.9868	0.9871	0.9874	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9924	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9980	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
z	3.00	3.10	3.20	3.30	3.40	3.50	3.60	3.70	3.80	3.90
P	0.9986	0.9990	0.9993	0.9995	0.9997	0.9998	0.9998	0.9999	0.9999	1.0000